I, Tadahiko Itoh, a Patent Attorney of Tokyo, Japan having my office at 32nd Floor, Yebisu Garden Place Tower, 20-3 Ebisu 4-Chome, Shibuya-Ku, Tokyo 150-6032, Japan do solemnly and sincerely declare that I am the translator of the attached English language translation and certify that the attached English language translation is a correct, true and faithful translation of Japanese Patent Application No. 2000-014931 to the best of my knowledge and belief.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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TITLE OF THE INVENTION

CHANNEL STRUCTURING METHOD AND BASE STATION PROVIDED THEREWITH

CLAIMS

1. In a channel structuring method that structures downlink channels by using n number of sub-carriers to modulate transmission signals using the orthogonal frequency division multiplexing method, and the time division multiplexing to multiplex them,

a channel structuring method having a stage to insert a common pilot signal and a common control channel signal into said n number of sub-carriers.

2. In the channel structuring method disclosed in claim 1,

a channel structuring method having

a stage for providing a time frame divided into required intervals for a communications channel of said n number of sub-carriers, and

a stage for selecting a required number of sub-carriers from said n number of sub-carriers and cyclically inserting a common pilot signal and a common control channel signal into each time frame of said selected sub-carriers.

3. In the channel structuring method disclosed in claim 2,

a channel structuring method characterised in said common pilot signal and common control channel signal cyclically inserted into each time frame of said selected sub-carrier, having either or both a common control channel signal and a common pilot signal inserted at the same timing as either or both of a common control channel signal and a common pilot signal for another sub-channel.

4. In the channel structuring method disclosed in claim 1,

a channel structuring method having

a stage for providing a time frame divided into required intervals for a communications channel of said n number of sub-carriers,

a stage for selecting a required number of sub-carriers from said n number of sub-carriers and continuously inserting a common control channel signal into each time frame of said selected sub-carriers, and

a stage selecting a required number of sub-carriers from said n number of sub-carriers and for cyclically inserting a common pilot signal into each time frame of said selected sub-carrier.

5. In the channel structuring method disclosed in claim 1,

a channel structuring method having

a stage for providing a time frame divided into required intervals for a communications channel of said n number of sub-carriers,

a stage for selecting a required number of sub-carriers from said n number of sub-carriers and continuously inserting a common pilot signal into each time frame of said selected sub-carriers, and

a stage selecting a required number of sub-carriers from said n number of sub-carriers and for cyclically inserting a common control channel signal into each time frame of said selected sub-carrier.

6. In the channel structuring method of claim 4 and claim 5, a channel structuring method characterized in a sub-carrier in which said common control channel signal is inserted and a sub-carrier into which a common pilot signal is inserted are

partially or wholly the same.

7. In the channel structuring method disclosed in claim 1,

a channel structuring method having

a stage for providing a time frame divided into required intervals for a communications channel of said n number of sub-carriers,

a stage for selecting a required number of sub-carriers from said n number of sub-carriers and continuously inserting a common control channel signal into the time frames of said selected sub-carriers, and

a stage selecting a required number of sub-carriers from said n number of sub-carriers and for continuously inserting a common pilot signal into a time frame of said selected sub-carriers.

8. In a base station structuring downlink channels using the orthogonal frequency division multiplexing method having n number of sub-carriers to modulate transmission signals, and the time division multiplexing to multiplex them,

a base station having

a common control channel signal insertion means to insert a common control channel signal into all or part of said n number of sub-carriers, and

a common pilot signal insertion means to insert a common pilot signal into all or part of said n number of sub-carriers.

FIELD OF THE INVENTION

The present invention relates to a channel structuring method and a base station provided therewith, and more particularly, relates to a downlink channel structuring method between a base station and a mobile station, and a base station using that method.

BACKGROUND ART

In general, mobile communications systems are used in multi-path environments where transmitted radio waves reach the receive side via various propagation paths. In such multi-path environments, signals that arrive delayed, interfere with present signals and this gives rise to characteristics deterioration known as inter-symbol interference.

However, transmission systems using the modulation method known as Orthogonal Frequency Division Multiplexing (OFDM) enable high-speed transmission to be realized in multi-path environments and without deterioration of the characteristics due to inter-symbol interference.

The reason for this is that in OFDM, the symbols become longer due to a wideband signal being divided across a plural number of mutually orthogonal sub-carriers and transmitted in parallel, and this alleviates the influence of inter-symbol interference. Because of this, various investigations are being carried out for mobile communications systems using OFDM as the modulation method.

A specific example of a mobile communications systems using OFDM as the modulation method is in "Performance of an OFDM-TDMA Mobile Communications System" (H. Rohling, R.Grunheid: Proc. Of IEEE VCT 1996, vol. 3, pp. 1589-1593, 1996), which investigates a method for performing communications between a mobile station and a base station using OFDM as the modulation method and time division multiple access (TDMA).

In this investigation, the characteristic of OFDM performing transmission by a plural number of sub-carriers was made use of to suitably allocate signals for transmission to a mobile station in accordance with the receive status of the sub-carrier at

the mobile station, thereby enabling the quality of communications to be enhanced.

In addition, in the same investigation was a "Performance Comparison of Different Multiple Access Methods Schemes for the Downlink of an OFDM Communication System" (Proc. Of IEEE VTC 1997, pp. 1365-1369, 1997).

In this investigation, there was OFDM transmission between a base station and a mobile station and so there is an example of a frame structure having a sync signal, a control signal and an information signal.

In addition, in mobile communications systems, a phenomenon known as phasing occurs due to changes in the relative position between the base station and the mobile station, and this influences the phase fluctuation and the amplitude fluctuation of the received signals. Accordingly, because there is the receive of signals by sync signals that have been transmitted using a mobile communications system, it is necessary to make an accurate assumption for amplitude fluctuation and phase fluctuation, and to have modulation that uses those assumed values to compensate for the fluctuation in the receive signals.

One method of assuming the amplitude fluctuation and phase fluctuation in the receive signals involves multiplexing a pilot symbol of a known phase, with the transmission signals, and then at the receive side, using this pilot symbol to assume the amplitude fluctuation and phase fluctuation for the received receive signals. In a mobile communications system using OFDM as the modulation method, the sync waves necessitate channel assumptions using the pilot symbol and various investigations are underway for this.

For example, in "Robust Channel Estimation for OFDM Systems with Rapid

Dispensive Fading Channels" (Y. Li, L.J. Cimini, N.R. Sollenberger. IEEE Transactions on Communications, vol. 46, nop.7 July 1998), there is disclosed a method for received OFDM signals, that combines a channel assumption for the time domain, and a channel assumption for the frequency domain.

In addition, in "Performance Analysis of an OFDM System Using Data-Aided Channel Estimation" (V. Kaasila: Proc. Of IEEE VTC 1999, pp. 2303-2307), there is an investigation into assuming channel fluctuation using the time interval that a pilot symbol has been multiplexed to transmission symbols to determine the pilot symbol for use in channel fluctuation assumptions.

PROBLEM TO BE SOLVED BY THE INVENTION

However, each one of these investigations described above was mainly proposed and evaluated as a method for enhancing the transmission quality. In order to use the OFDM/TDM (Time Division Multiplexing) transmission method for downlinks in mobile communications systems, it is necessary to have a method of structuring common control channels for transmission of control signals between base stations and mobile stations.

In particular, when OFDM is used as the modulation method, it is necessary to consider the use of channels in the frequency domain and not just those in the time domain, since there is parallel transmission over a plural number of channels.

Furthermore, when a pilot symbol is inserted, it is necessary to know what weighting the pilot symbol has, and also to consider how the pilot symbol is to be inserted. When the pilot symbol is inserted, it is necessary to investigate countermeasures for the phenomenon of physical phasing.

In the light of the above, the present invention has as an object the provision of a channel structuring method that enables a common pilot signal and a common control channel signal to be inserted into a downlink channel between a base station and a mobile station, and to provide a base station using this method.

MEANS OF SOLUTION TO THE PROBLEM

In order to solve the problems described above, the present invention is a channel structuring method that structures downlink channels by using n number of sub-carriers to modulate transmission signals using the orthogonal frequency division multiplexing method, and the time division multiplexing to multiplex them, characterised in having a stage to insert a common pilot signal and a common control channel signal into said n number of sub-carriers.

In such a channel structuring method as this, it is possible to insert a common control channel signal and a common pilot signal into a downlink channel between a base station and a mobile station and thereby realize a channel structure for the transmission of common control signals between a base station and a mobile station. In addition, it is possible to insert common pilot signals into a downlink channel and so have a countermeasure for phasing phenomena.

From the point of view of selecting a sub-carrier for the insertion of a common control channel signal and a common pilot signal into a sub-carrier, and of inserting a common pilot signal and a common control channel signal into that selected sub-carrier, the present invention is, as disclosed in claim 2, said channel structuring method having a stage for providing a time frame divided into required intervals for a communications channel of said n number of sub-carriers, and a stage for selecting a required number of

sub-carriers from said n number of sub-carriers and cyclically inserting a common pilot signal and a common control channel signal into each time frame of said selected sub-carriers.

In such a channel structuring method, a required number of sub-carriers is selected from n number of sub-carriers and a common control channel signal and common pilot signal are inserted into each time frame of those selected sub-carriers. That common control channel signal and common pilot signal can be cyclically inserted.

From the point of view of having a common pilot signal and the common control channel signal inserted into the selected sub-carrier at the same timing as the common pilot signal and the common control channel signal inserted into other sub-carriers, the present invention is the channel structuring method disclosed in claim 3, characterised in said common pilot signal and common control channel signal cyclically inserted into each time frame of said selected sub-carrier, being inserted at the same timing as either or both of a common control channel signal and a common pilot signal for another sub-carrier.

In this manner, the insertion of the common pilot signal and the common control channel signal into the selected sub-carrier at the same timing as the common pilot signal and the common control channel signal inserted into other sub-carriers, facilitates control at the base station and the mobile station.

From the point of view of the common control channel signal being continuously inserted into a time frame of the selected sub-carrier, as disclosed in claim 4, the present invention is characterised in having a stage for providing a time frame divided into required intervals for a communications channel of said n number of sub-carriers, a stage

for selecting a required number of sub-carriers from said n number of sub-carriers and continuously inserting a common control channel signal into each time frame of said selected sub-carriers, and a stage selecting a required number of sub-carriers from said n number of sub-carriers and for cyclically inserting a common pilot signal into each time frame of said selected sub-carrier.

In this manner, the common control channel signals can be continuously inserted into a time frame of a selected sub-carrier, and the common pilot signals can by cyclically inserted into each time frame of a selected sub-carrier.

From the point of view of the common pilot signals being continuously inserted into a time frame of a selected sub-carrier, as disclosed in claim 5, the present invention is said channel structuring method, characterized in having a stage for providing a time frame divided into required intervals for a communications channel of said n number of sub-carriers, a stage for selecting a required number of sub-carriers from said n number of sub-carriers and continuously inserting a common pilot signal into the time frames of said selected sub-carriers, and a stage selecting a required number of sub-carriers from said n number of sub-carriers and for cyclically inserting a common control channel signal into each time frame of said selected sub-carrier.

In this manner, the common control channel signals can be continuously inserted into a time frame of a selected sub-carrier, and the common pilot signals can by cyclically inserted into each time frame of a selected sub-carrier.

From the point of view of having a correspondence when the sub-carrier into which the common control channel signals are inserted, overlaps the sub-carrier into which the common pilot signals are inserted, as disclosed in claim 6, the present invention is

characterized in said sub-carriers into which the common pilot signals are inserted being partially or wholly the same as the sub-carriers into which said common control channel signals are inserted.

In this manner, it is possible to insert common pilot signals into sub-carriers into which common control channel signals have been continuously inserted, and to insert common control channel signals into sub-carriers into which common pilot signals have been continuously inserted.

From the point of view of continuously inserting common control channel signals and common pilot signals into time frames of a selected sub-carrier, as disclosed in claim 7, the present invention is characterized in said channel structuring method having a stage for providing a time frame divided into required intervals for a communications channel of said n number of sub-carriers, a stage for selecting a required number of sub-carriers from said n number of sub-carriers and continuously inserting a common control channel signal into the time frames of said selected sub-carriers, and a stage selecting a required number of sub-carriers from said n number of sub-carriers and for continuously inserting a common pilot signal into a time frame of said selected sub-carriers.

In this manner, it is possible to continuously insert common control channel signals and common pilot signals in pairs into a time frame of a selected sub-carrier.

From the point of view of structuring a downlink channel into which a common control channel signal and common pilot signal have been inserted, the present invention is a base station that uses n number of sub-carriers to modulate transmission signals using the orthogonal frequency division multiplexing method, and the time division multiplexing to multiplex them, and having a common control channel signal insertion

means to insert a common control channel signal into all or part of said n number of sub-carriers, and a common pilot signal insertion means to insert a common pilot signal into all or part of said n number of sub-carriers.

Such a base station can insert common control channel signals and common pilot signals into a downlink channel. This is to say that it is possible to realize a channel structure for transmission of common control channel signals between a base station and a mobile station. In addition, the insertion of common pilot signals into the downlink channel makes it possible to have a countermeasure for phasing phenomena.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following is a description of preferred embodiments of the present invention, with reference to the appended drawings.

FIG. 1 is a block diagram of one example of an apparatus for realizing the channel structuring method of the present invention. In FIG. 1, the information sources 1a~1n output information signals such a voice and data for transmission from a base station to a mobile station.

The information signals output from information sources 1a ~ 1n are modulated by modulation portions 2a ~ 2n and are supplied to a time-division multiplexer (TDM) portion 3. The time-division multiplexer (TDM) portion 3 performs time-division multiplexing for the modulated information signals. At the adder 4, the time-division multiplexed signals have common pilot signals supplied from the common pilot signal insertion portion 6, inserted into them, and at the adder 5, have common control channel signals supplied from the common control channel insertion portion 7 inserted into them.

Here, a common control channel includes notification channels and auxiliary

control channels generally used in mobile communications systems. The signals that have had the common pilot signals and the common control channels signals inserted at the adder 4 and the adder 5, are supplied to the OFDM modulation portion 8.

The OFDM modulation portion 8 performs OFDM modulation for the supplied signals and outputs transmission signals having a channel structure that will be described later. Moreover, the common pilot signals and the common control channel signals can for example, be time-multiplexed by changing the allocated sub-carrier for each time, or frequency multiplexed by changing the signals allocated to each sub-carrier.

The following is a description of the channel structure of the transmission signals, with reference to the appended drawings. FIG. 2 is a diagram of a channel structure of a first embodiment, for describing the channel structuring method of the present invention. The following is a description of an OFDM method having sub-carriers from sub-carrier 1 ~ sub-carrier n (where in is an natural number).

In FIG. 2, common control channel signals and common pilot signals are time-multiplexed and inserted into the communications channels of each of the sub-carriers 1 ~ n. Specifically, the common control channel signals and common pilot signals are inserted to insertion positions SC1-1, SC1-2, etc. shown in FIG. 2.

Moreover, at insertion position SC1-1, etc., it is possible to have only the common control channels signal, only the common pilot signal, or both the common control channel signal and common pilot signal. In addition, it is possible to select an arbitrary method as the method for time multiplexing the common control channel signal and common pilot signal with the communications channel of each of the sub-carriers 1~n, and inserting them to the insertion position SC1-1.

FIG. 3 is a channel structuring diagram of a second embodiment, for describing the channel structuring method of the present invention. In FIG. 3, the sub-carriers 10, 11, 12 for inserting the common control channel signals and common pilot signals are selected, and common control channel signals and common pilot signals are time multiplexed and inserted into those selected sub-carriers 10, 11, 12.

Moreover, it is possible to include only the common control channel signal, only the common pilot signal, or both the common control channel signal and common pilot signal in the selected sub-carrier 10, etc. In addition, it is possible to select an arbitrary method as the method for frequency multiplexing the common control channel signal and share pilot signal to the selected sub-carrier 10, etc.

FIG. 4 shows a channel structuring diagram of a third embodiment, for describing the channel structuring method of the present invention. In FIG. 4, a time frame having delimiters at fixed time intervals is provided to the communications channels of n number of sub-carriers 1 ~ n.

First, an arbitrary number k of sub-carriers (where k is an natural number; k   n) is selected from n number of sub-carriers 1 ~ n, and common control channel signals are cyclically inserted into each time frame. In addition, one of an arbitrary number of sub-carriers (where 1 is an natural number; 1   n) is selected from n number of sub-carriers and a common pilot signal is cyclically inserted into each time frame.

For example, the common control channel signals are inserted into insertion positions SC1-1, SC1-3 of sub-carrier 1. In addition, common pilot signals are inserted into insertion positions SC1-2 and SC1-4 of sub-carrier 1. In addition, the insertion position of the common control channel signals and common pilot signals is selected by a

timing that differs for each sub-carrier.

Moreover, the relative insertion position and length of time of the common control channel signal and common pilot signal in each time frame can be an arbitrary insertion position and arbitrary length of time.

FIG. 5 is a channel structuring method of a fourth embodiment, for describing a channel structuring method of the present invention. Moreover, the channel structuring method of FIG. 5 is the same as that of the third embodiment in that time frames are provided to the communications channels of n number of sub-carriers 1~n, an arbitrary number of sub-carriers is selected from n number of sub-carriers, and common control channel signals and common pilot signals are inserted, and therefore duplicate descriptions of these portions is omitted.

Here, the channel structure of a fourth embodiment of the present invention is characterized in the insertion positions of the common control channel signals having the same timing for each sub-carrier. In addition, the insertion positions of the common pilot signals are selected by timing that is different for each sub-carrier.

For example, common control channel signals are inserted to insertion position SC1-1 of sub-carrier 1, and to insertion position SC2-1 of sub-carrier 2, for example. In addition, common pilot signals are inserted to insertion position SC1-2 of sub-carrier 1, and to insertion position SC2-2 of sub-carrier 2.

Moreover, it is possible for the relative insertion positions and lengths of time of the common control channel signal and common pilot signal in each time frame to be an arbitrary insertion position and arbitrary length of time.

FIG. 6 is a view of a channel structuring method of a fifth embodiment, for

describing a channel structuring method of the present invention. Moreover, the channel structuring method of FIG. 6 is the same as that of the third embodiment in that time frames are provided to the communications channels of n number of sub-carriers 1~n, an arbitrary number of sub-carriers is selected from n number of sub-carriers, and common control channel signals and common pilot signals are inserted, and therefore duplicate descriptions of these portions is omitted.

Here, the channel structuring method of the fifth embodiment of the present invention is characterized in that the insertion position of the common pilot signal has the same timing for each of the sub-carriers. In addition the insertion position of the common control channel signal is selected at a timing that is different for each sub-carrier.

For example, common control channel signals are inserted to insertion position SC1-1 of sub-carrier 1, and to insertion position SC2-1 of sub-carrier 2, for example. In addition, common pilot signals are inserted to insertion position SC1-2 of sub-carrier 1, and to insertion position SC2-2 of sub-carrier 2.

Moreover, it is possible for the relative insertion positions and lengths of time of the common control channel signal and common pilot signal in each time frame to be an arbitrary insertion position and arbitrary length of time.

FIG. 7 is a view of a channel structuring method of a sixth embodiment, for describing a channel structuring method of the present invention. Moreover, the channel structuring method of FIG. 7 is the same as that of the third embodiment in that time frames are provided to the communications channels of n number of sub-carriers 1~n, an arbitrary number of sub-carriers is selected from n number of sub-carriers, and common control channel signals and common pilot signals are inserted, and therefore duplicate

descriptions of these portions is omitted.

Here, the channel structuring method of the sixth embodiment of the present invention is characterized in that the insertion position of the common control channel signal and the common pilot signal has the same time timing for each of the sub-carriers.

For example, common control channel signals are inserted to insertion position SC1-1 of sub-carrier 1, and to insertion position SC2-1 of sub-carrier 2, for example. In addition, common pilot signals are inserted to insertion position SC1-2 of sub-carrier 1, and to insertion position SC2-2 of sub-carrier 2.

Moreover, it is possible for the relative insertion positions and lengths of time of the common control channel signal and common pilot signal in each time frame to be an arbitrary insertion position and arbitrary length of time.

FIG. 8 is a view of a channel structuring method of a seventh embodiment, for describing a channel structuring method of the present invention. In FIG. 8, a time frame having delimiters at fixed time intervals is provided to the communications channel of n number of sub-carriers 1 ~ n.

First, an arbitrary number k of sub-carriers (where k is an natural number; k n) is selected from n number of sub-carriers 1 ~ n, and common control channel signals and common pilot signals are cyclically inserted in pairs into each time frame.

For example, the common control channel signals and common pilot signals are inserted into insertion positions SC1-1, SC1-2 of sub-carrier 1. In addition, the positions for insertion of the pairs of common control channel signals and common pilot signals are selected at a different timing for each sub-carrier such as insertion position SC1-1 for sub-carrier 1, and insertion position SC2-1 for sub-carrier 2, etc.

Moreover, the relative insertion position and length of time of the common control channel signal and common pilot signal in each time frame can be an arbitrary insertion position and arbitrary length of time.

FIG. 9 is a channel structuring method of an eighth embodiment, for describing a channel structuring method of the present invention. Moreover, the channel structuring method of FIG. 9 is the same as that of the seventh embodiment in that time frames are provided to the communications channels of n number of sub-carriers 1~n, an arbitrary number of sub-carriers is selected from n number of sub-carriers, and common control channel signals and common pilot signals are inserted, and therefore duplicate descriptions of these portions is omitted.

Here, the channel structure of an eighth embodiment of the present invention is characterized in the insertion positions of the pairs of common control channel signals and common pilot signals have the same timing for each sub-carrier.

For example, the insertion positions of the pairs of common control channel signals and common pilot signals are selected at the same timing for each sub-carrier such as insertion position SC1-1 for sub-carrier 1, and insertion position SC2-1 for sub-carrier 2, etc.

Moreover, it is possible for the relative insertion positions and lengths of time of the common control channel signal and common pilot signal in each time frame to be an arbitrary insertion position and arbitrary length of time.

FIG. 10 is a view of a channel structuring method of a ninth embodiment, for describing a channel structuring method of the present invention. In FIG. 10, a time frame having delimiters at fixed time intervals is provided to the communications channel of n

number of sub-carriers 1 ~ n.

First, an arbitrary number k of sub-carriers (where k is an natural number; k n) is selected from n number of sub-carriers 1 ~ n, and common control channel signals are cyclically inserted into each time frame of the selected sub-carrier. For example, the common control channel signals are continuously inserted into time frames of the selected sub-carriers 1 and 3.

In addition, one of an arbitrary number of sub-carriers (where 1 is an natural number; 1 n) is selected from n number of sub-carriers and a common pilot signal is cyclically inserted into each time frame. For example, a common pilot signal is inserted into insertion positions SC2-1, SC4-1 of selected sub-carriers 2 and 4. Moreover, the insertion positions of the common pilot signals is selected at either the same time timing or a different time timing for each sub-carrier.

Here, the channel structure of a ninth embodiment of the present invention is characterized the sub-carriers into which common control channel signals are inserted are different from the sub-carriers into which common pilot signals are inserted. Moreover, it is possible for the relative insertion positions and lengths of time of the common control channel signal and common pilot signal in each time frame to be an arbitrary insertion position and arbitrary length of time.

FIG. 11 is a view of a channel structuring method of a fifth embodiment, for describing a channel structuring method of the present invention. Moreover, the channel structuring method of FIG. 11 is the same as that of the third embodiment in that time frames are provided to the communications channels of n number of sub-carriers 1~n, an arbitrary number of sub-carriers is selected from n number of sub-carriers, and common

control channel signals and common pilot signals are inserted, and therefore duplicate descriptions of these portions is omitted.

Here, the channel structuring method of the tenth embodiment of the present invention is characterized in that the sub-carrier into which the common control channel signal is inserted, partially overlaps the sub-carrier into which the common pilot signal is inserted.

For example, when the common control channel signals are continuously inserted into a time frame, the sub-carrier 1 allocates the insertion position SC1-1 so that common pilot signals are inserted. As a result, a common pilot signal is inserted to insertion position SC1-1 for sub-carrier 1, and common control channel signals are continuously inserted into time frames other than for insertion position SC1-1 for the common pilot signal.

Moreover, it is possible for the relative insertion positions and lengths of time of the common control channel signal and common pilot signal in each time frame to be an arbitrary insertion position and arbitrary length of time.

FIG. 12 is a view of a channel structuring method of an eleventh embodiment, for describing a channel structuring method of the present invention. In FIG. 12, a time frame having delimiters at fixed time intervals is provided to the communications channel of n number of sub-carriers 1 ~ n.

First, an arbitrary number k of sub-carriers (where k is an natural number; k n) is selected from n number of sub-carriers 1 ~ n, and common control channel signals are cyclically inserted in pairs into each time frame. For example, the common control channel signals are inserted into insertion positions SC2-1, SC4-1 of sub-carriers 1 and 4.

Moreover, the insertion positions of the common control channels signals are selected at either the same time timing or a different time timing for each sub-carrier.

In addition, one of an arbitrary number of sub-carriers (where 1 is a natural number; 1 n) is selected from n number of sub-carriers and a common pilot signal is inserted into each time frame. For example, a common pilot signal is continuously inserted into time frames of the selected sub-carriers 1 and 3.

Next, the channel structure of an eleventh embodiment of the present invention is characterized in sub-carriers to which common control channel signals are inserted, are different from sub-carriers to which common pilot signals are inserted.

Moreover, it is possible for the relative insertion positions and lengths of time of the common control channel signal and common pilot signal in each time frame to be an arbitrary insertion position and arbitrary length of time.

FIG. 13 is a diagram of channel structuring in a twelfth embodiment, for describing the channel structuring method of the present invention. Moreover, the channel structuring method of FIG. 13 is the same as that of the eleventh embodiment in that time frames are provided to the communications channels of n number of sub-carriers 1~n, an arbitrary number of sub-carriers is selected from n number of sub-carriers, and common control channel signals and common pilot signals are inserted, and therefore duplicate descriptions of these portions is omitted.

Here, the channel structuring method of the twelfth embodiment of the present invention is characterized in that the sub-carrier into which the common control channel signal is inserted, partially overlaps the sub-carrier into which the common pilot signal is inserted.

For example, when the common control channel signals are continuously inserted into a time frame, the sub-carrier 1 allocates the insertion position SC1-1 so that common control channel signals are inserted. As a result, a common control channel signal is inserted to insertion position SC1-1 for sub-carrier 1, and common pilot signals are continuously inserted into time frames other than for insertion position SC1-1 for common pilot signals.

Moreover, it is possible for the relative insertion positions and lengths of time of the common control channel signal and common pilot signal in each time frame to be an arbitrary insertion position and arbitrary length of time.

FIG. 14 is a diagram showing the channel structuring of a thirteenth embodiment, for describing the channel structuring method of the present invention. In FIG. 14, a time frame having delimiters at fixed time intervals is provided to the communications channel of n number of sub-carriers 1 ~ n.

First, an arbitrary number k of sub-carriers (where k is an natural number; k   n) is selected from n number of sub-carriers 1 ~ n, and common control channel signals are continuously inserted in pairs into each time frame. For example, common control channel signals are continuously inserted into time frames of selected sub-carriers 1 and 3.

In addition, one of an arbitrary number of sub-carriers (where 1 is an natural number; 1   n) is selected from n number of sub-carriers and a common pilot signal is continuously inserted into each time frame. For example, a common pilot signal is continuously inserted into time frames of the selected sub-carriers 2 and 4.

Next, the channel structure of a thirteenth embodiment of the present invention is characterized in common control channel signals and common pilot signals are

continuously inserted in pairs into selected sub-carriers.

As has been described above, the use of the channel structuring of the first through thirteenth embodiments of the present invention enables the insertion of a common control channel signal and a common pilot signal into the downlink channel between a base station and a mobile station using the OFDM/TDM transmission system.

Accordingly, it is possible to realize a channel structuring method for insertion of, and to realize a base station using this method.

EFFECT OF THE INVENTION

As has been described above, according to the present invention, it is possible to insert a common pilot signal and a common control channel signal into a downlink channel between a base station and a mobile station and to realize a channel configuration for the transmission of common control signals between a base station and a mobile station.

Accordingly, it is possible to use the OFDM/TDM transmission system for use as a downlink in a mobile communications system.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is one example of a block diagram for the realization of the channel structuring method of the present invention,

FIG. 2 is a first embodiment of a channel structuring method, for describing the channel structuring method of the present invention,

FIG. 3 is a second embodiment of a channel structuring method, for describing the channel structuring method of the present invention,

FIG. 4 is a third embodiment of a channel structuring method, for describing the

channel structuring method of the present invention,

FIG. 5 is a fourth embodiment of a channel structuring method, for describing the channel structuring method of the present invention,

FIG. 6 is a fifth embodiment of a channel structuring method, for describing the channel structuring method of the present invention,

FIG. 7 is a sixth embodiment of a channel structuring method, for describing the channel structuring method of the present invention,

FIG. 8 is a seventh embodiment of a channel structuring method, for describing the channel structuring method of the present invention,

FIG. 9 is a eighth embodiment of a channel structuring method, for describing the channel structuring method of the present invention,

FIG. 10 is a ninth embodiment of a channel structuring method, for describing the channel structuring method of the present invention,

FIG. 11 is a tenth embodiment of a channel structuring method, for describing the channel structuring method of the present invention,

FIG. 12 is a eleventh embodiment of a channel structuring method, for describing the channel structuring method of the present invention,

FIG. 13 is a twelfth embodiment of a channel structuring method, for describing the channel structuring method of the present invention, and

FIG. 14 is a thirteenth embodiment of a channel structuring method, for describing the channel structuring method of the present invention.

DESCRIPTION OF THE SYMBOLS

1a ~ 1n information source

2a ~ 2n modulation portion

3 time division multiplexing portion

4, 5 adder

6 common pilot signal insertion portion

7 common control channel signal insertion portion

8 OFDM modulation portion

10 ~ 12 sub-carrier

SC1-1, SC2-1, SC3-1 insertion positions

ABSTRACT

PURPOSE: An object is to provide a method for inserting a common control channel signal and a common pilot signal into the downlink channel between a base station and a mobile station and to provide a base station using this method.

CONFIGURATION: The above object can be attained by a stage providing a time frame divided into required intervals for a communications channel of said n number of sub-carriers, and a stage for selecting a required number of sub-carriers from said n number of sub-carriers and cyclically inserting a common pilot signal and a common control channel signal into the time frames of said selected sub-carriers.

FIG. 1: Example of a block diagram for the realization of the channel structuring method of the present invention

1a information source (data, voice, etc.)

1b information source (data, voice, etc.)

1n information source (data, voice, etc.)

2a modulation portion

2b modulation portion

2n modulation portion

3 time-division multiplexing (TDM) portion

6 common pilot signal insertion portion

7 common control channel signal insertion portion

8 OFDM modulation portion

transmission signal

FIG. 2: First embodiment of a channel structuring method, for describing the channel structuring method of the present invention

Sub-carrier 1

Sub-carrier 2

Sub-carrier n

Multiplexing common control channel signal and common pilot signal with information signal and inserting into communications channel of sub-carrier

Position of insertion of common control channel signal and common pilot signal

FIG. 3: Second embodiment of a channel structuring method, for describing the channel structuring method of the present invention

Frequency

Multiplexing common control channel signal and common pilot signal with information signal and inserting into communications channel of sub-carrier

FIG. 4: Third embodiment of a channel structuring method, for describing the channel structuring method of the present invention

k selected from n number of sub-carriers

1 selected from n number of sub-carriers

Sub-carrier 1

Sub-carrier 2

Sub-carrier n

Position of insertion of common control channel signal (timing different for each sub-carrier)

Position of insertion of common pilot signal (timing different for each sub-carrier)

FIG. 5: Fourth embodiment of a channel structuring method, for describing the channel structuring method of the present invention

k selected from n number of sub-carriers

1 selected from n number of sub-carriers

Sub-carrier 1

Sub-carrier 2

Sub-carrier n

Position of insertion of common control channel signal (timing same for each sub-carrier)

Position of insertion of common pilot signal (timing different for each sub-carrier)

FIG. 6: Fifth embodiment of a channel structuring method, for describing the channel structuring method of the present invention

k selected from n number of sub-carriers

1 selected from n number of sub-carriers

Sub-carrier 1

Sub-carrier 2

Sub-carrier n

Position of insertion of common control channel signal (timing different for each sub-carrier)

Position of insertion of common pilot signal (timing same for each sub-carrier)

FIG. 7: Sixth embodiment of a channel structuring method, for describing the channel structuring method of the present invention

k selected from n number of sub-carriers

1 selected from n number of sub-carriers

Sub-carrier 1

Sub-carrier 2

Sub-carrier n

Position of insertion of common control channel signal (timing same for each sub-carrier)

Position of insertion of common pilot signal (timing same for each sub-carrier)

FIG. 8: Seventh embodiment of a channel structuring method, for describing the channel structuring method of the present invention

k (= 1) selected from n number of sub-carriers

Sub-carrier 1

Sub-carrier 2

Sub-carrier n

Position of insertion of pairs of common control channel signals and common pilot signals (timing different for each sub-carrier)

FIG. 9: Eighth embodiment of a channel structuring method, for describing the channel structuring method of the present invention

k (= 1) selected from n number of sub-carriers

Sub-carrier 1

Sub-carrier 2

Sub-carrier n

Position of insertion of pairs of common control channel signals and common pilot signals (timing same for each sub-carrier)

FIG. 10: Ninth embodiment of a channel structuring method, for describing the channel structuring method of the present invention

k selected from n number of sub-carriers

1 selected from n number of sub-carriers

Sub-carrier 1

Sub-carrier 2

Sub-carrier 3

Sub-carrier 4

Sub-carrier n

Position of insertion of common control channel signal (continuous insertion for

each sub-carrier)

Position of insertion of common pilot signal (timing can be either the same or different for each sub-carrier)

FIG. 11: Tenth embodiment of a channel structuring method, for describing the channel structuring method of the present invention

k selected from n number of sub-carriers

1 selected from n number of sub-carriers

Sub-carrier 1

Sub-carrier 2

Sub-carrier 3

Sub-carrier 4

Sub-carrier n

Position of insertion of common control channel signal (continuous insertion for each sub-carrier)

Position of insertion of common pilot signal (timing can be either the same or different for each sub-carrier)

FIG. 12: Eleventh embodiment of a channel structuring method, for describing the channel structuring method of the present invention

k selected from n number of sub-carriers

1 selected from n number of sub-carriers

Sub-carrier 1

Sub-carrier 2

Sub-carrier 3

Sub-carrier 4

Sub-carrier n

Position of insertion of common control channel signal (timing can be either the same or different for each sub-carrier)

Position of insertion of common pilot signal (continuous insertion for each sub-carrier)

FIG. 13: Twelfth embodiment of a channel structuring method, for describing the channel structuring method of the present invention

k selected from n number of sub-carriers

1 selected from n number of sub-carriers

Sub-carrier 1

Sub-carrier 2

Sub-carrier 3

Sub-carrier 4

Sub-carrier n

Position of insertion of common control channel signal (timing can be either the same or different for each sub-carrier)

Position of insertion of common pilot signal (continuous insertion for each sub-carrier)

FIG. 14: Thirteenth embodiment of a channel structuring method, for describing the channel structuring method of the present invention

k selected from n number of sub-carriers

1 selected from n number of sub-carriers

Sub-carrier 1

Sub-carrier 2

Sub-carrier 3

Sub-carrier 4

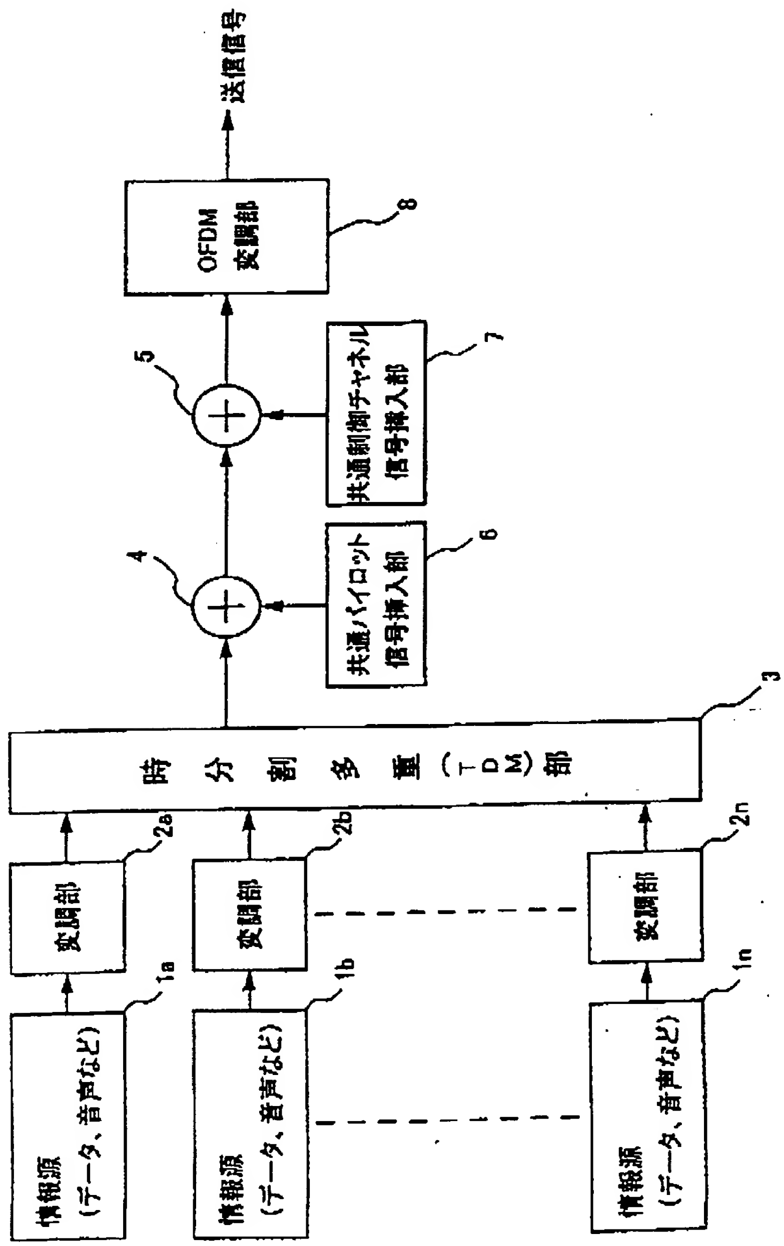
Sub-carrier n

Position of insertion of common control channel signal (continuous insertion for each sub-carrier)

Position of insertion of common pilot signal (continuous insertion for each sub-carrier)

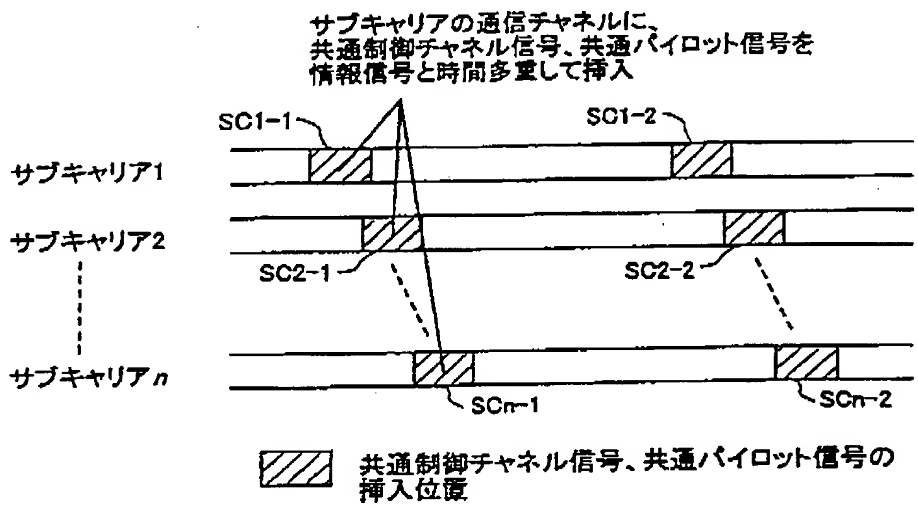
【書類名】　図面
[Document Name]　Drawing
【図1】

本発明のチャネル構成方法を実現する装置の一例のブロック図



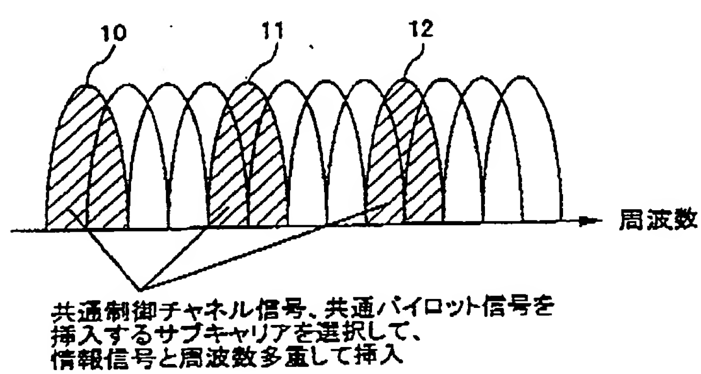
【図２】

本発明のチャネル構成方法について説明する第1実施例のチャネル構成図



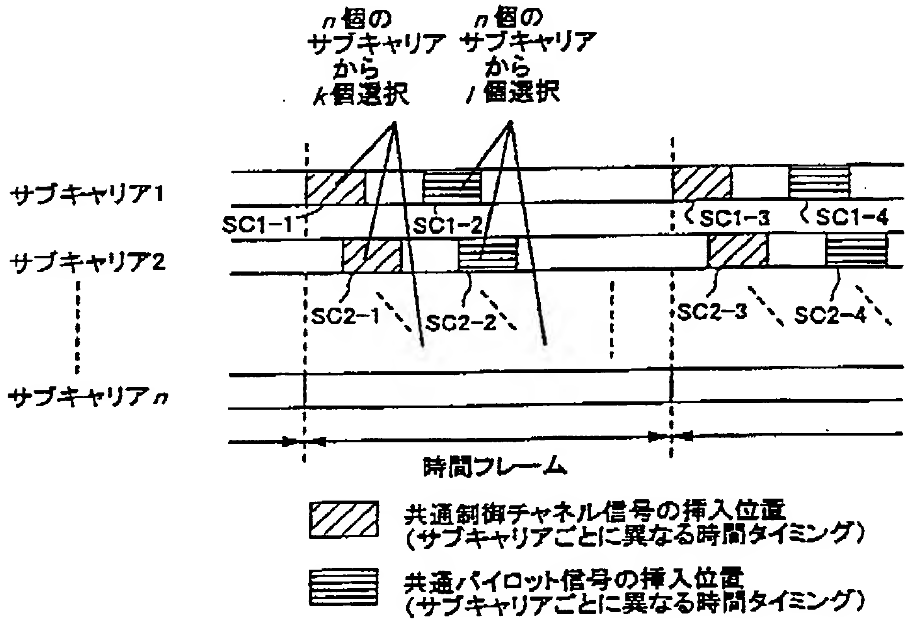
【図３】

本発明のチャネル構成方法について説明する第2実施例のチャネル構成図



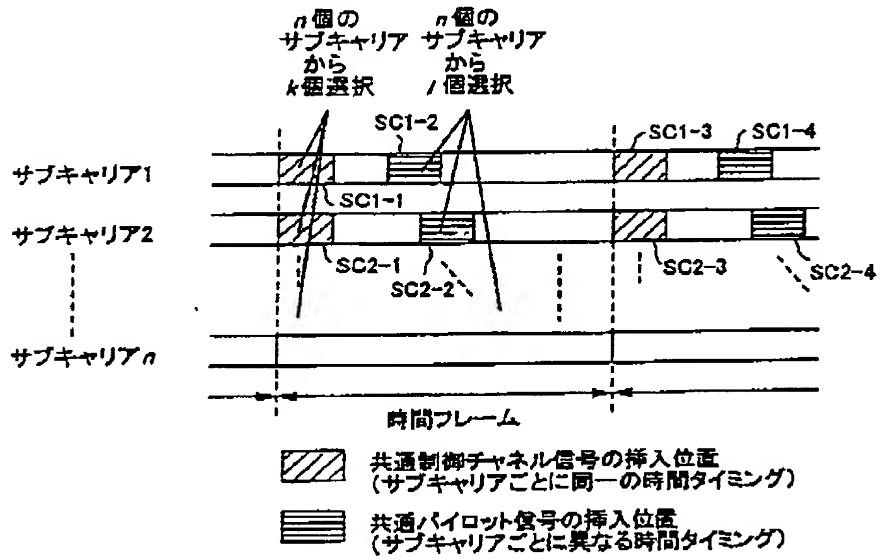
【図４】

本発明のチャネル構成方法について説明する第3実施例のチャネル構成図



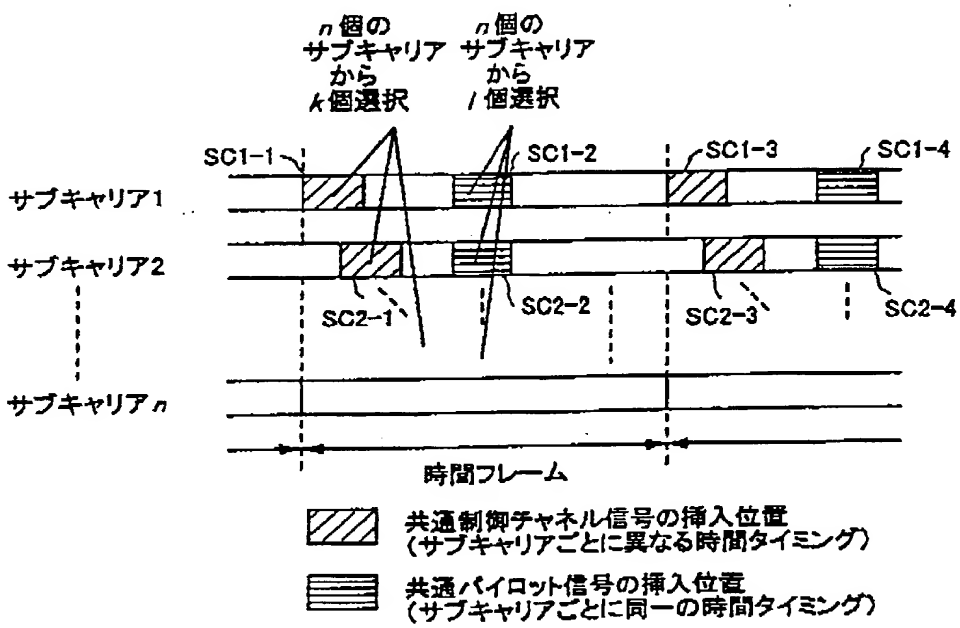
【図５】

本発明のチャネル構成方法について説明する第4実施例のチャネル構成図



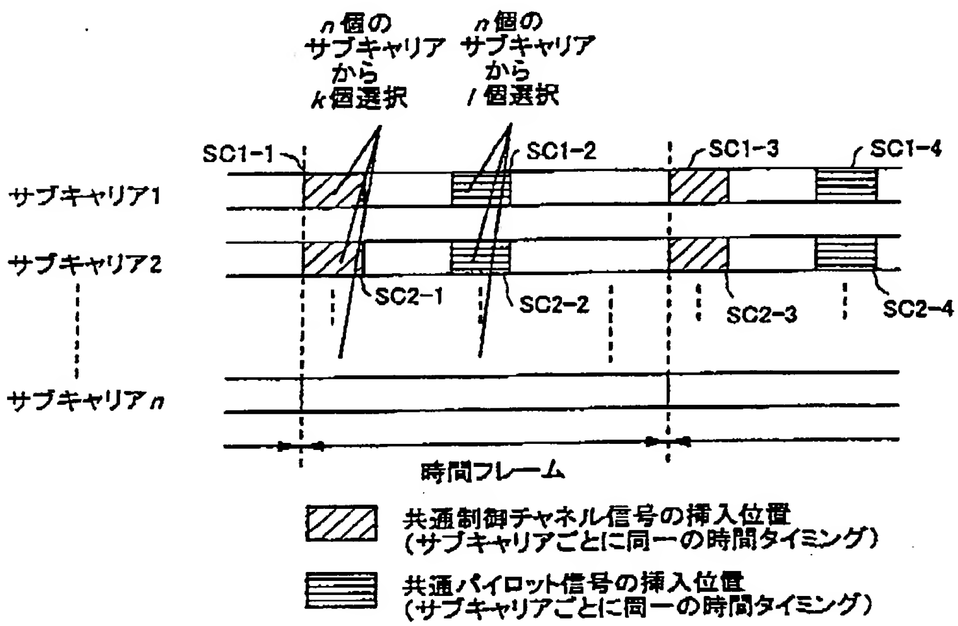
【図６】

本発明のチャネル構成方法について説明する第5実施例のチャネル構成図



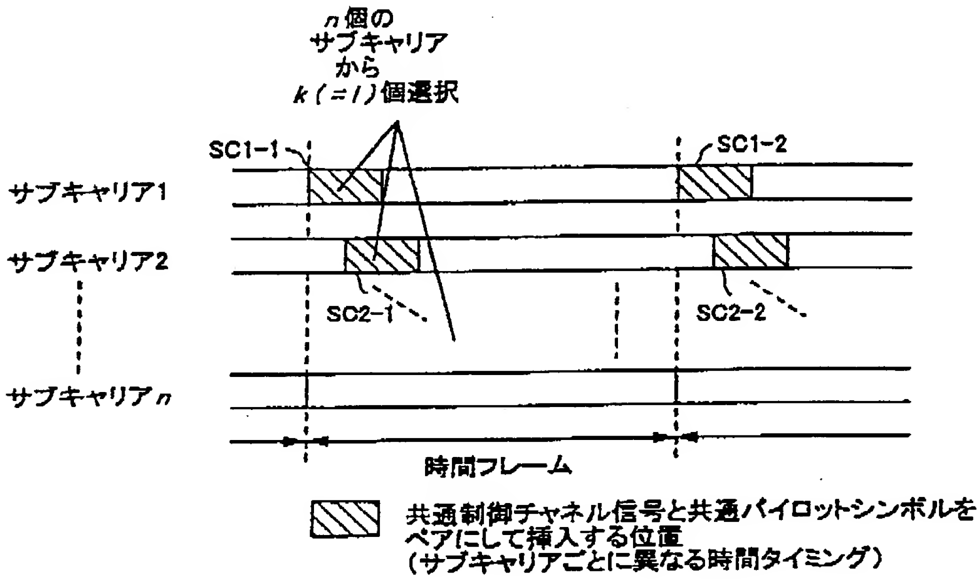
【図７】

本発明のチャネル構成方法について説明する第6実施例のチャネル構成図



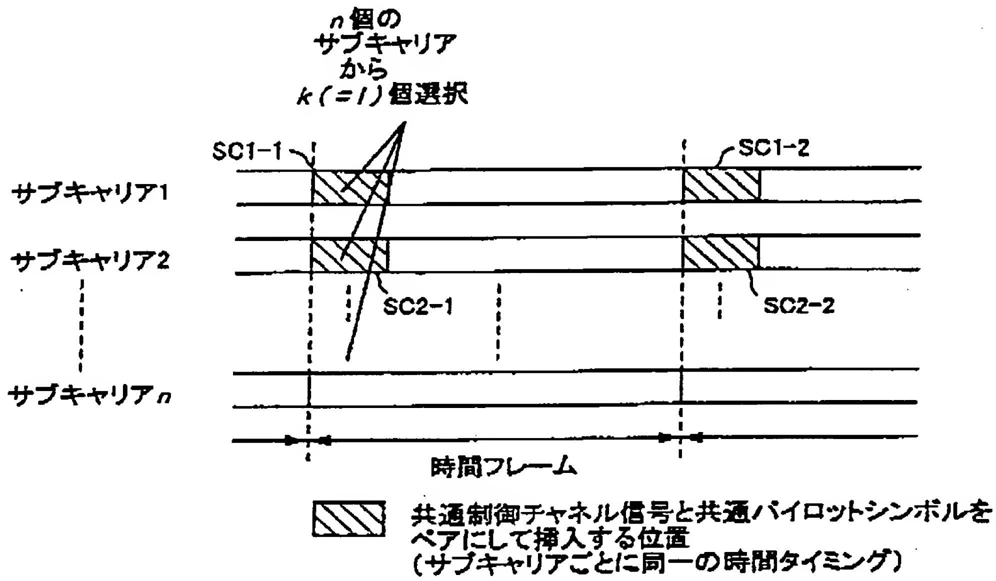
【図８】

本発明のチャネル構成方法について説明する第7実施例のチャネル構成図



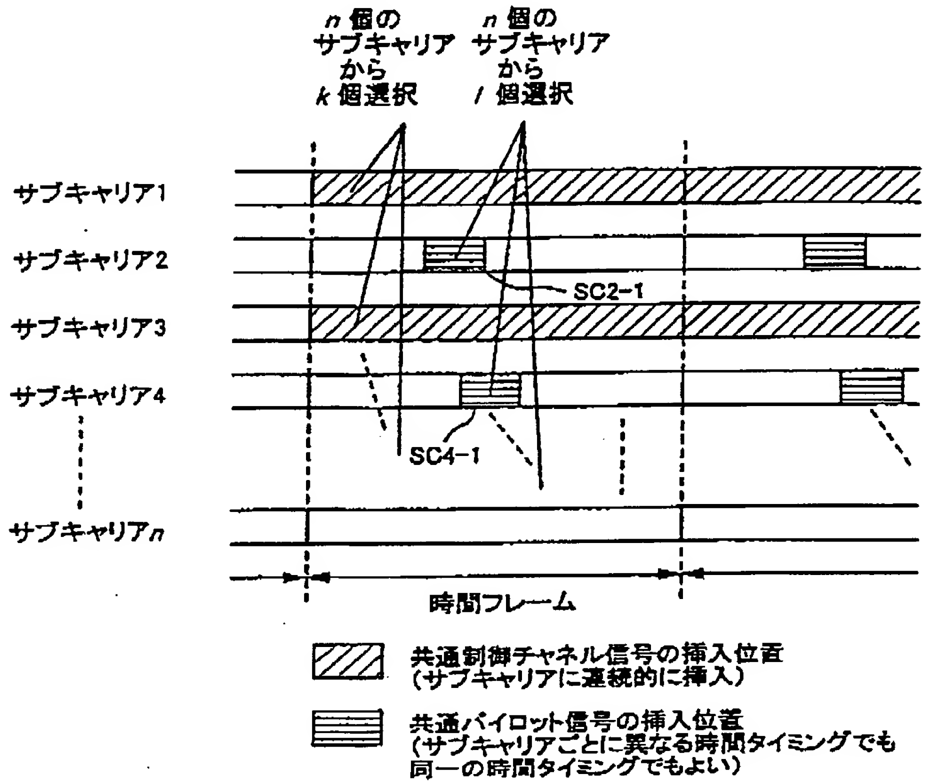
【図９】

本発明のチャネル構成方法について説明する第8実施例のチャネル構成図



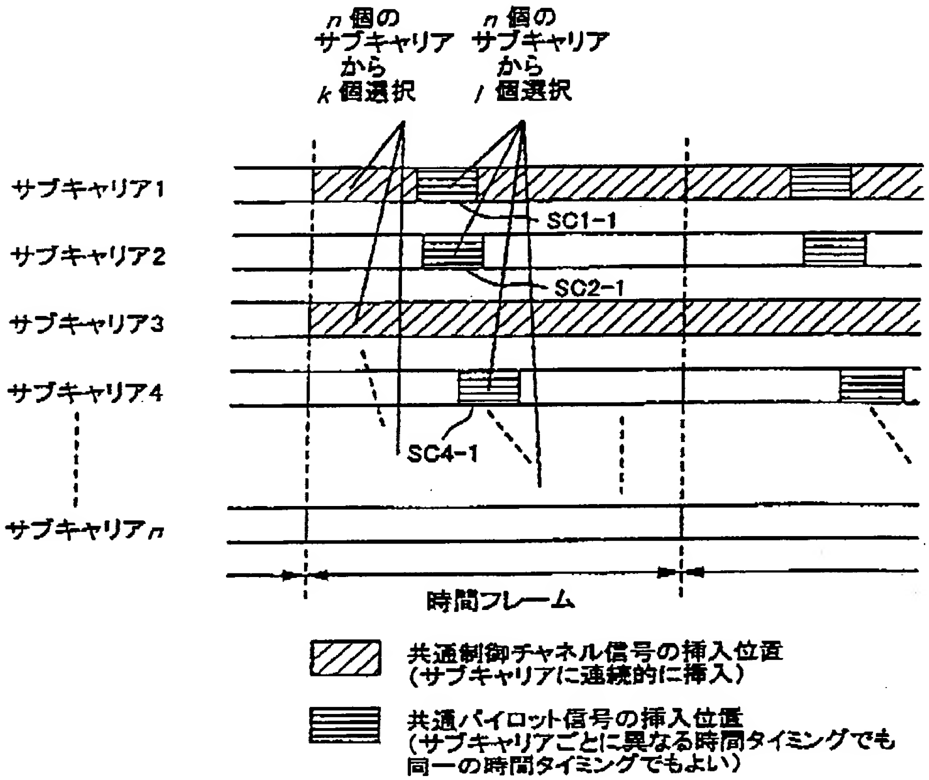
【図１０】

本発明のチャネル構成方法について説明する第9実施例のチャネル構成図



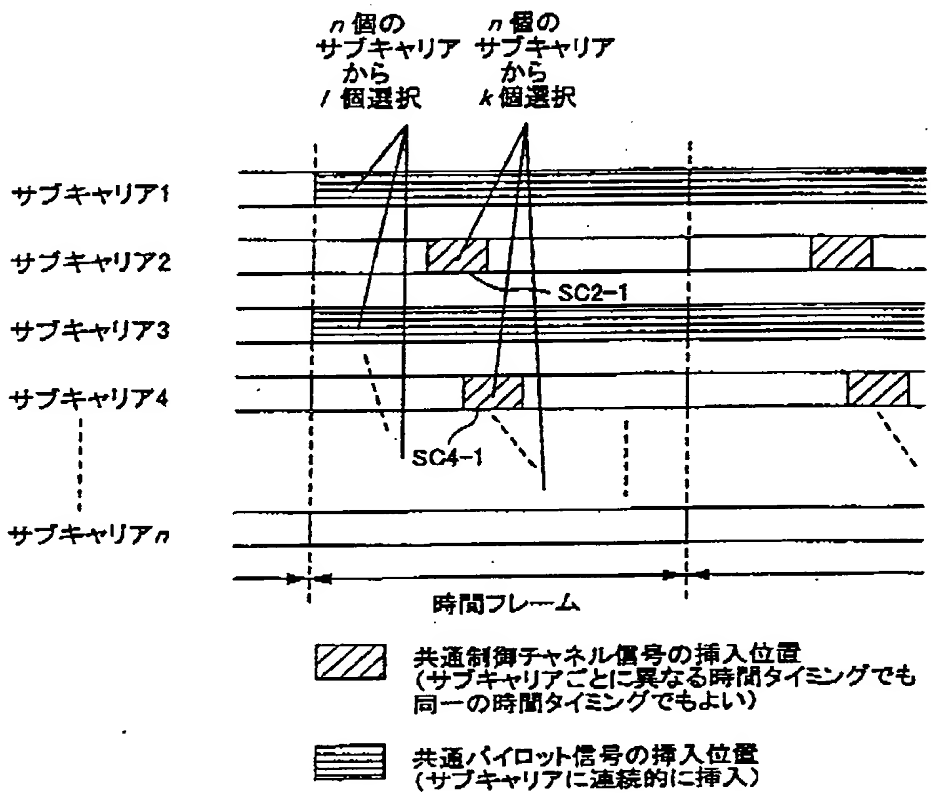
【図１１】

本発明のチャネル構成方法について説明する第10実施例のチャネル構成図



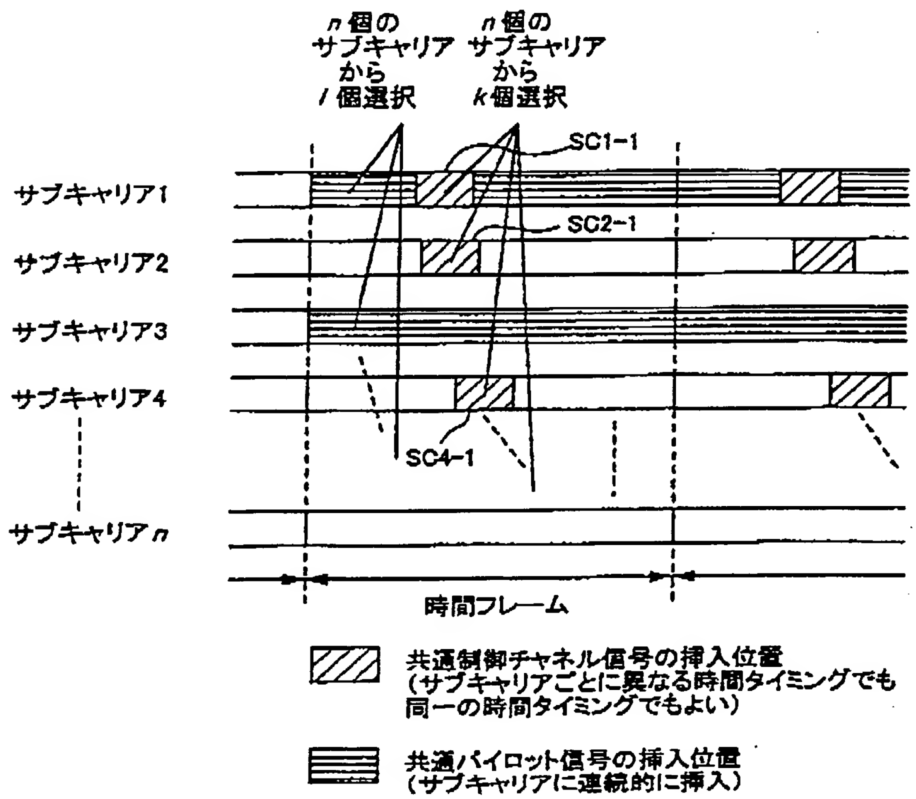
【図１２】

本発明のチャネル構成方法について説明する第11実施例のチャネル構成図



【図１３】

本発明のチャネル構成方法について説明する第12実施例のチャネル構成図



【図１４】

本発明のチャネル構成方法について説明する第13実施例のチャネル構成図